UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

June 7, 2022

OFFICE OF
LAND AND EMERGENCY
MANAGEMENT

MEMORANDUM

SUBJECT: Open Burning and Open Detonation (OB/OD) of Waste Explosives Under the Resource Conservation and Recovery Act (RCRA)

FROM: Carolyn Hoskinson, Director
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TO: Land, Chemicals, and Redevelopment Division Directors, Regions 1-10

Purpose and Scope

The purpose of this memorandum is to communicate existing requirements and provide guidance to EPA Regions, states, and territories for permitting open burning/open detonation (OB/OD) units under the Resource Conservation and Recovery Act (RCRA) to protect human health and the environment.

Regions, states, and territories must not permit OB/OD units that do not meet existing requirements. In addition, permitting authorities should consider the guidance described in this memorandum before permitting OB/OD units.

Key Points:

- In 1980, EPA prohibited OB/OD of hazardous waste due to the potential risks to human health and the environment. EPA allowed one exception for OB/OD to treat waste explosives with no safe mode of treatment.
- In 2019, EPA and the National Academies of Sciences, Engineering, and Medicine (NASEM) published separate reports that document safe alternatives are available for managing many waste explosives. This memorandum responds to questions on how to apply the existing requirements, in light of this information.
- Under the existing requirements, OB/OD facilities **must** evaluate—and re-evaluate—whether safe alternative technologies are available to treat their waste explosives. Where safe alternatives are available, facilities **must** use those alternatives in lieu of OB/OD.
- EPA acknowledges that OB/OD will still be needed to treat waste explosives that do not yet have other safe modes of treatment. Where OB/OD is needed, EPA is providing guidance regarding recommended permit conditions for OB/OD units to reduce impacts to human health and the environment.
- EPA acknowledges that implementation may be complex; EPA encourages communication among EPA, states, territories, tribes, local communities, and facility owners with respect to site-specific permitting decisions to ensure protection of human health and the environment.

Specifically, this memorandum communicates the existing requirements under RCRA that prohibit open burning, including open detonation, of hazardous waste, except for the open burning and detonation of waste explosives that cannot safely be disposed of through other modes of treatment. This includes regulations for interim status facilities under Title 40 Code of Federal Regulations (CFR) 265.382 and requirements applicable to facilities permitted under Title 40 CFR Part 264, Subpart X (Miscellaneous Units).

Owners/operators of OB/OD units subject to these requirements, as further explained below, must demonstrate and periodically redemonstrate that they are eligible and remain eligible for the exception to the prohibition against open burning, including open detonation, of hazardous waste (e.g., as part of permit issuance and renewal or as a permit condition). Owners/operators of OB/OD units that identify safe available alternatives for their waste explosives must use those alternative technologies instead of OB/OD.

OB/OD Impacts on Communities and Need for Community Engagement:

- EPA is committed to improving the health of communities and advancing equity in environmental protections, working in collaboration with our state and territorial partners.
- Community groups have raised concerns to EPA about operating OB/OD units and exposure to contaminants through inhalation from plumes of smoke migrating into communities and ingestion from contaminants deposited onto soil and leached into groundwater used for irrigation and drinking water.
- Community groups have also indicated that many communities near operating OB/OD units are communities with environmental justice concerns and may face additional pollution burdens that increase their vulnerability.
- It is important to engage with communities on a site-specific basis on permitting activities for these facilities, to learn about citizens' concerns and share information so that they can effectively participate in the permitting process, and so that permitting actions can fully consider and address issues that impact community health. EPA recommends that EPA Regions, states, and territories work with the facility to develop a public participation/community engagement/public notification plan.
- Recognizing the public's important role in the RCRA permitting process, EPA regulations create opportunities for public input to incorporate valuable information and ideas that improve the quality of agency decisions. Specifically, the pre-application meeting, public comment and response periods, and public hearings are all instances where citizens, permit applicants, and regulators can engage in dialogue to ensure protectiveness and transparency.
- The RCRA regulatory requirements, discussed in detail below, provide that alternative technologies must be evaluated and used where available; and that RCRA permits issued to alternative technologies and, where needed, OB/OD units, must be designed to protect human health and the environment.
- Use of safe alternative technologies in general represents a greater level of control and more complete treatment, and therefore better protection of nearby communities and the environment.
- Any permits issued to OB/OD facilities must include conditions that protect the health of communities. This includes, for example and as appropriate, protective distance requirements, limits on duration and timing of OB/OD events, monitoring of environmental media, engineering controls to reduce off-site impacts to communities, and noise and vibration thresholds.

EPA is taking this action to communicate existing requirements and provide guidance in light of information in two 2019 reports that identify available technologies that can safely treat most, if not all, wastes that are currently being open burned and many wastes that are being open detonated.[1,2] EPA is developing a new rulemaking to clarify these requirements; however, in the interim, permitting authorities must act on the existing requirements and should consider EPA's guidance contained in this memorandum.

Background of Regulatory Requirements

Because of the potential hazards to human health and the environment, in 1980, EPA banned open burning, including open detonation, of hazardous waste at interim status facilities with one exception – EPA allowed OB/OD for waste explosives "which cannot safely be disposed of through other modes of treatment" (45 FR 33217, May 19, 1980; 40 CFR 265.382).[3,4] This exception, or variance, from the ban on OB/OD was not intended to be indefinite. At the time, EPA also committed to monitoring development of new technologies.[5]

Waste explosives, as defined in 40 CFR 265.382, "include waste which has the potential to detonate and bulk military propellants which cannot safely be disposed of through other modes of treatment." Waste explosives are characteristic for reactivity (D003) under 40 CFR 261.23(a)(6-8).[6] Example waste explosives include military munitions, explosives and gun and rocket propellants (e.g., RDX, HMX, IMX, TNT, and perchlorate), fireworks, and flares.

After establishing interim status standards for thermal treatment, EPA finalized permitting standards in 1987 for hazardous waste management units that were not already covered in the regulations, including OB/OD (40 CFR Part 264, Subpart X — Miscellaneous Units).[7] Under Subpart X, a miscellaneous unit "must be located, designed, constructed, operated, maintained and closed in a manner that will ensure protection of human health and the environment" (40 CFR 264.601).

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[1] Alternative Treatment Technologies to Open Burning and Open Detonation of Energetic Hazardous Wastes, U.S. EPA, December 2019 https://www.epa.gov/sites/production/files/2019-12/documents/final_obod_alttechreport_for_publication_dec2019_508_v2.pdf.

[2] Alternatives for the Demilitarization of Conventional Munitions, NASEM, January 2019 https://www.nap.edu/catalog/25140/alternatives-for-the-demilitarization-of-conventional-munitions.

[3] The 1980 final rule followed EPA's proposed rule, published in 1978, which proposed to prohibit open burning of hazardous waste unless the owner/operator "can demonstrate that alternative treatment and disposal methods…have been evaluated and determined to be technically or economically infeasible or that the transport, treatment, and disposal of such waste poses a greater risk to human health or the environment than open burning." 43 FR 59000, December 18, 1978.

[4] 45 FR 33217, May 19, 1980. "The Agency agrees that open burning and open detonation are currently the only alternatives for disposal of most munitions, and thus a modified and more detailed version of the proposed variance for waste explosives has been retained in the final rules."

[5] Final Background Document, 40 CFR part 265, subpart P Interim Status Standards for Hazardous Waste Facilities for Thermal Treatment Processes Other Than Incineration and for Open Burning. U.S. EPA, Office of Solid Waste, April 1980; p. 52. "The Agency will be monitoring the progress of the on-going development of safe alternatives and may propose additional regulations at a later time."

[6] The U.S. Department of Defense (DoD), Instruction 4140.62, establishes policy for the management of Material Potentially Presenting an Explosive Hazard (MPPEH), Material Documented as an Explosive Hazard (MDEH), and Material Documented as Safe (MDAS) at DoD facilities. According to DoD, MPPEH must be assessed and certified as either MDEH or MDAS prior to treatment or disposal. Under RCRA, all materials (e.g., MPPEH, MDEH, and MDAS) must be evaluated to determine if they are a RCRA solid waste prior to recycling, treatment (including by open burning or open detonation) or disposal. MDEH determined to be a RCRA solid waste is a RCRA hazardous waste and may be eligible for treatment by OB/OD. MPPEH and MDAS should never be treated by OB/OD.

[7] 52 FR 46964, December 10, 1987.

In the 1987 final rule, EPA used the 40 CFR 265.382 definition of waste explosives to explain what OB/OD operations could and could not be permitted under Subpart X. Specifically, EPA listed OB/OD of explosive waste as an example unit covered under Subpart X, referring to units "as defined in § 265.382."[8] EPA also concluded in the 1987 final rule that open burning of nonexplosive waste could not be conducted in a manner that was protective of human health and the environment, stating the Agency "made this finding in 1980 in promulgating the general ban on open burning of nonexplosive hazardous waste (40 CFR 265.382) and has no new information to suggest this conclusion should be revised. The Agency, therefore, intends to deny any permit applications it receives under Subpart X for such activities."[9]

The Subpart X regulations further direct that permits for such "miscellaneous units" must "contain such terms and provisions as are necessary to protect human health and the environment" (40 CFR 264.601), and permitting authorities generally incorporate applicable provisions from the existing EPA regulations. EPA stated in the preamble to the 1987 rule that "[w]hen upgrading existing units or permitting new units, the applicable portions of Part 265 Subpart P standards (e.g., minimum safe distances) *will be* incorporated during issuance of Subpart X permits" (emphasis added).[10,11] Thus, EPA has long interpreted Subpart X as incorporating the provisions of 40 CFR 265.382 when applied to OB/OD activities.

RCRA Section 3005(c)(1) directs EPA to issue a permit "upon a determination by the Administrator (or a State, if applicable), of compliance by a facility…with the requirements of this section and section [3004]." This means that to obtain a permit, an interim status facility would need to demonstrate compliance with 40 CFR 265.382 before issuance of the permit. Moreover, given the record concerning the risks associated with OB/OD, EPA considers that the incorporation of the qualified prohibition in 40 CFR 265.382 would be necessary to ensure that such units are "operated… in a manner that will ensure protection of human health and the environment" (40 CFR 264.601). RCRA Section 3005(c) also directs the Administrator (or State), prior to issuing a permit, to "consider improvements in the state of control and measurement technology" in reviewing an application for a permit renewal. (42 U.S.C. 6925(c)(1), (3)). Accordingly, EPA expects that Subpart X permits would only be issued for OB/OD units treating waste explosives as defined in 40 CFR 265.382, and that such permits would incorporate the prohibition on OB/OD except for waste explosives "which cannot safely be disposed of through other modes of treatment" in light of the most recent information on available alternative technologies.

Also relevant are the provisions in the statute and regulations which provide authority for agency-initiated permit modifications, as well as for "enforceable comments." Under these provisions, Regional, state, and territorial RCRA programs could consider whether cause exists to initiate a modification of existing permits not currently up for renewal to incorporate the terms and conditions listed below. RCRA Section 3005(c)(3) stipulates the Administrator (or authorized state) can review and modify a permit at any time during its term. In accordance with this direction, 40 CFR 270.41(a)(2) authorizes Regional, state, and territorial permitting authorities to modify or revoke and reissue a permit based on "information [that] was not available at the time of permit issuance …and would have justified the application of different permit conditions at the time of issuance" such as the information contained in

[8] 52 FR 46952, December 10, 1987.
[9] 52 FR 46952-3, December 10, 1987.
[10] 52 FR 46952, December 10, 1987.
[11] In addition, shortly after publication of the Subpart X final permitting standards, EPA confirmed that "[a]ll thermal treatment is subject to Part 265, Subpart P; if this was not the case, the standards would not be the same…." Memorandum from Marcia E. Williams, Director of Office of Solid Waste to Robert F. Greaves, EPA Region 3 Acting Chief Waste Management Branch, December 15, 1987, RO 11310.

the two 2019 reports (discussed below). Under 40 CFR 271.19, EPA Regions can indicate in a comment during review of state permits, that issuance of a permit without the requirements in 40 CFR 265.382 would be inconsistent with the approved state program provisions implementing Subpart X. EPA would then have authority to take enforcement action against a permittee that does not comply with the permit condition identified as necessary, whether or not that condition was included in the final permit.

Overview of OB/OD and Development of Alternative Technologies

Open burning and open detonation lack the controls needed for the efficient and complete combustion of wastes and the ability to control and measure the emission of combustion products.[12] Waste explosives, when open burned or open detonated, have the potential to release to the environment heavy metals, perchlorate, particulate matter, per- and polyfluoroalkyl substances (PFAS[13]), dioxins/furans, explosive compounds, and other toxic and hazardous contaminants.[14] Contamination of air, soils, surface water, sediments, and groundwater has been caused by OB/OD through release and deposition of hazardous residuals, explosive kickout, and contaminants.[15,16] In addition, EPA has preliminary information that shows that clean closure of OB/OD units, including the removal of hazardous waste residuals and explosive kickout, is generally difficult and costly to achieve. Community groups have raised concerns to EPA about operating OB/OD units and exposure to contaminants through inhalation from plumes of smoke migrating into communities. In addition, communities are concerned about contaminants deposited onto soil that can leach into groundwater or be taken up by plants, posing ingestion concerns for nearby communities generally and especially for those with wells that may be used for drinking and irrigation water. Community groups have also indicated that many communities near operating OB/OD

[12] Open burning, as defined in 40 CFR 260.10, "means the combustion of any material without the following characteristics: (1) Control of combustion air to maintain adequate temperature for efficient combustion, (2) Containment of the combustion-reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion, and (3) Control of emission of the gaseous combustion products." Detonation, as defined in 40 CFR 265.382, is an "explosion in which chemical transformation passes through the material faster than the speed of sound…."

[13] EPA's 2020 Interim Guidance on the Destruction and Disposal of Perfluoroalkyl and Polyfluoroalkyl Substances and Materials Containing Perfluoroalkyl and Polyfluoroalkyl Substances (https://www.epa.gov/pfas/interim-guidance-destroying-and-disposing-certain-pfas-and-pfas-containing-materials-are-not) evaluated available destruction and disposal technologies for the management of PFAS and concluded that significant uncertainties remain with respect to the potential for migration to the environment. However, acknowledging a need to make informed decisions for managing PFAS in a manner as protective of the environment as possible, a hierarchy was established. In this hierarchy of lower to higher uncertainty (1 = lower, 6 = higher), hazardous waste combustors and other thermal treatment ranked 5th and 6th, respectively. Thus, given the high uncertainty assigned to enclosed thermal treatment, OB/OD of PFAS can be reasonably assumed to have even greater uncertainty due to the lack of combustion unit controls and air pollution controls.

[14] https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern.

[15] EPA has documented contaminants that exceed action levels in environmental media at closed OB/OD units. These contaminants include explosives (RDX, HMX, perchlorate, TNT, DNT, nitroglycerine), heavy metals (aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, phosphorus, selenium, silver, sodium, thallium, zinc), and other contaminants (arochlor, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dioxins/furans, DNB, dibromoethane (EDB), endosulfan, ethylbenzene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, nitrates, nitrobenzene, TNB, xylenes.) Information about specific chemicals, including information on health and environmental impacts, can be found on EPA's CompTox Chemicals Dashboard https://comptox.epa.gov/dashboard/.

[16] Incomplete treatment during OB/OD operations can result in the release of hazardous and/or explosive waste residuals and explosive kickout, which can constitute land disposal, and pose a threat to human health or the environment, especially if not removed in a timely manner. For the purpose of compliance with the Land Disposal Restriction (LDR) treatment standards, EPA determined that OB/OD was treatment, not disposal. However, EPA clarified that OB/OD constitutes land disposal where residuals [on the land] from the OB/OD operation remain a hazardous waste. Memorandum from Sylvia Lowrance, Director of Office of Solid Waste to Robert Duprey, EPA Region 8, Director Hazardous Waste Management Division, May 18, 1988, RO 13184.

units are communities with environmental justice concerns and may face additional pollution burdens that increase their vulnerability.

Since 1980, approximately two thirds of all OB/OD units have ceased operating. However, as of May 2022, there are still 66 currently operating OB/OD facilities. States have permitted most of these operating facilities' OB/OD units as RCRA hazardous waste treatment units under 40 CFR Part 264 Subpart X, although three facilities are still operating in interim status (i.e., awaiting initial permit decisions).[17]

In 2019, the EPA[18] and the National Academies of Sciences, Engineering, and Medicine (NASEM)[19] published separate reports describing many alternative technologies now available to safely treat explosive waste instead of using OB/OD.[20] Both reports indicated that there are safe available alternative technologies for most, if not all, waste streams that are currently being open burned and many wastes that are being open detonated. Use of safe alternative technologies in general represents a greater level of control and more complete treatment, and therefore better protection of human health and the environment—capturing and controlling emissions and releases to the environment is more protective compared to treatment open to the environment. In addition, since these technologies prevent or greatly reduce the release of hazardous contaminants to the environment, they are expected to result in lower lifecycle costs as compared to OB/OD, when taking into account costs for closure and cleanup.

In light of these reports, EPA is issuing this policy memorandum to communicate the existing requirements and provide guidance for permitting OB/OD units. EPA has also initiated a rulemaking to propose changes to the RCRA regulations to clarify existing requirements, including how to apply and implement the requirements in the permitting process. For example, the rulemaking will consider what specific information should be required for facilities to demonstrate whether safe modes of treatment are available for specific waste streams. Until further regulatory action is taken, permitting authorities must act on the existing requirements and should consider EPA's guidance contained in this memorandum to ensure protection of human health and the environment.

OB/OD is generally the least environmentally preferred treatment technology for waste explosives and, consistent with existing requirements, should only be used where there are no other safe modes of treatment. EPA acknowledges that OB/OD, while being the least preferred technology, will still be needed to treat waste explosives that do not yet have other safe modes of treatment. OB/OD units treating explosive waste are permitted under 40 CFR Part 264, Subpart X Miscellaneous Units; under the Subpart X environmental performance standards, "permits for miscellaneous units are to contain such terms and provisions as necessary to protect human health and the environment, including, but not limited to, as appropriate, design and operating requirements, detection and monitoring requirements,

[17] The three OB/OD facilities operating under interim status are: (1) U.S. Army Picatinny Arsenal (New Jersey), (2) Naval Support Facility Indian Head (Maryland), and (3) Los Alamos National Laboratory (New Mexico).

[18] Alternative Treatment Technologies to Open Burning and Open Detonation of Energetic Hazardous Wastes, U.S. EPA, December 2019 https://www.epa.gov/sites/production/files/2019-12/documents/final_obod_alttechreport_for_publication_dec2019_508_v2.pdf. "There is a wide range of available alternative treatment technologies that can be, and have been used successfully, in place of OB/OD."

[19] Alternatives for the Demilitarization of Conventional Munitions, NASEM, January 2019 https://www.nap.edu/catalog/25140/alternatives-for-the-demilitarization-of-conventional-munitions. "There are no significant technical, safety, or regulatory barriers to the full-scale deployment of alternative technologies for the demilitarization of the vast majority of the conventional waste munitions, bulk energetics, and associated wastes."

[20] Alternative technologies can be categorized according to the treatment needs which include case opening, energetic material removal, energetic material destruction, and decontamination. Each of these categories contain specific technologies. For example, Closed Detonation is an energetic material destruction technology.

and requirements for responses to releases of hazardous waste or hazardous constituents from the unit" (40 CFR 264.601). In this memorandum, EPA is providing guidance to EPA Regions, states, and territories to include specific permitting conditions applicable to OB/OD units.

Existing Requirements for Permitting OB/OD Units

Open burning of hazardous waste, including open detonation, is currently prohibited under RCRA, except for the open burning and detonation of waste explosives, as defined in 40 CFR 265.382, which cannot safely be disposed of through other modes of treatment.[21,22]

Facilities subject to this requirement must demonstrate that their waste explosives "cannot safely be disposed of through other modes of treatment" to qualify for the exception and use OB/OD. To do so, the facility must successfully demonstrate, through an evaluation of alternative technologies, that there are no other technologies that can safely treat each waste stream. Because new technologies routinely become available, a facility must periodically reevaluate, e.g., at permit issuance and renewal, whether this condition has been met to maintain compliance with this requirement. Periodic reevaluation is required even if the facility has previously made this evaluation to satisfy its interim status obligation under 40 CFR 265.382 or to satisfy a permit condition established under Subpart X. This is particularly true given the findings in the 2019 EPA and NASEM published reports which identify safe available alternative technologies for most, if not all waste streams that are currently being open burned and many waste explosives that are being open detonated.

In addition, whenever an OB/OD permit is issued, the permit must include the requirements at § 265.382, as well as the terms and conditions outlined below. It is important that the permit specifically includes conditions requiring periodic re-evaluation to determine whether other safe modes of treatment have been developed, so that this requirement remains enforceable during the life of the permit. This would include both the circumstance in which the permit is issued to an interim status facility and in response to an application to renew a permit for an OB/OD unit. Inclusion of such requirements is also consistent with the direction in RCRA Section 3005(c) to determine compliance with the RCRA Section 3004 requirements prior to issuing a permit, and to "consider improvements in the state of control and measurement technology" in reviewing an application for a permit renewal (42 U.S.C. 6925(c)(1), (3)).

EPA acknowledges that implementing the below requirements may be complex in terms of determining whether safe alternative technologies are available for certain wastes at specific facilities. EPA encourages communication among EPA, states, territories, tribes, local communities, and facility owners with respect to site-specific permitting decisions.

Specifically, Regional, state, and territorial permitting authorities, consistent with existing requirements, must:

- Require owners/operators seeking an initial or renewal permit for OB/OD to demonstrate that their waste explosives "cannot safely be disposed of through other modes of treatment" in order to qualify for the exception. Specifically, for a particular waste to be permitted for OB/OD, the facility must successfully demonstrate, through accurate waste characterization[23] and an

[21] Regulations found in 40 CFR parts 264 and 265 were promulgated under RCRA § 3004 (42. U.S.C. § 6924).
[22] This prohibition applies regardless of whether a facility has completed a site-specific risk analysis that demonstrates protectiveness.
[23] See recommendations for detailed waste characterization further below.

evaluation of alternative technologies, that the waste has the potential to detonate and that there are no other technologies that can safely treat that waste stream.[24] OB/OD may be needed to treat waste explosives during the time alternative technologies are being evaluated. See also the below recommended actions to minimize waste generation and reduce wastes being treated by OB/OD.

- Require facilities to use safe available alternative technologies. [25] More than one type of alternative technology may be needed to address different waste streams. In addition, available alternative technologies include technologies that need custom design and construction to meet site-specific requirements. OB/OD may be needed to treat waste explosives during the time an alternative technology is being designed, permitted, constructed, and deployed. See also the below recommended actions to minimize waste generation and reduce wastes being treated by OB/OD.

- Deny permit applications for OB/OD of nonexplosive waste as the Agency has concluded these activities cannot be conducted in a manner that is protective of human health and the environment and cannot be permitted under 40 CFR Part 264, Subpart X. Permit applications for OB/OD units must only be considered for waste explosives, as defined in 40 CFR 265.382, "which cannot safely be disposed of through other modes of treatment."

- Establish permit conditions for OB/OD units that ensure protection of human health and the environment, including, but not limited to, as appropriate, design and operating requirements, detection and monitoring requirements, and requirements for responses to releases of hazardous waste or hazardous constituents from the units (40 CFR 264.601).

- Establish permit conditions for OB/OD units that include the requirements at § 265.382, and conditions for permit renewal and modification requiring periodic re-evaluation of alternative technologies and use of safe available alternative technologies. For waste explosives that cannot safely be disposed of through other modes of treatment, ensure that the minimum distance from the OB/OD unit to the property of others is met (40 CFR 265.382).

EPA Guidance for Permitting OB/OD Units

EPA is providing further guidance below to Regional, state, and territorial permitting authorities to assist in implementing the existing requirements described above.

[24] As stated in EPA's 2019 report, safety has historically been cited as a primary reason for using OB/OD. For DoD, among the many factors in choosing an alternative technology in place of OB/OD, is whether the technology meets safety mandates. DoD's Explosives Safety Board (DDESB) is responsible for determining whether a technology meets safety mandates for site-specific or munition-specific applications. According to DoD, for a given technology, additional factors in determining the production-ready availability of alternatives include the demonstrated capability that the technology can be successfully operated in a production environment for extended periods without significant failures or unreasonable support costs to keep it operational. Per DoD, technologies that have poor availability, reliability, maintainability, affordability, and supportability are not sustainable systems, and are therefore not considered by DoD to be viable production-ready capability solutions. The DDESB has approved alternative technologies for use at various military installations.

[25] EPA is generally not authorized to consider cost under RCRA. Thus, cost is not a consideration when determining whether there are safe available alternative technologies for purposes of complying with these requirements.

Priorities and Overview

EPA Regions, states, and territories should prioritize the permitting of and assure the implementation of alternative technologies to reduce or potentially eliminate the need for OB/OD as soon as possible and reduce impacts on communities. Top priority would be interim status and permitted OB/OD units located in floodplains, near waterways, near communities, near property boundaries, or which have documented offsite releases.

OB/OD is generally the least environmentally preferred treatment technology and, consistent with existing requirements, should only be available where there are no safe modes of treatment. While EPA understands that there will continue to be a need for OB/OD for waste explosives that cannot yet safely be disposed of through other modes of treatment, EPA seeks to promote the development, testing, and use of alternative technologies that are capable of safely treating munitions and other waste explosives in a manner that reduces the potential for exposure and environmental contamination, as well as limits cleanup and closure obligations.

EPA recommends that Regional, state, and territorial RCRA programs carefully evaluate the two 2019 reports prior to taking any action with respect to OB/OD units. The two 2019 reports provide facilities, and Regional, state, and territorial RCRA programs, information for determining whether safe modes of treatment are now available for wastes currently being managed, or proposed to be managed, by OB/OD, including under interim status, a RCRA permit, corrective action, remedial action plan, or an enforcement action.

In evaluating alternative technologies, note also that treating waste explosives may be a multi-step process, depending on the starting material and its configuration. As discussed in the 2019 reports, some wastes may need pre-processing to change the size, shape, or configuration of items, or otherwise modify the waste to ensure effective and safe treatment. Specifically, EPA's 2019 report identifies technologies available to disassemble and remove energetic material from munitions and other waste explosives items.[26] Safe and available alternative technologies should effectively treat specific waste streams while capturing and controlling emissions.

Per 40 CFR part 264 subpart X, Regional, states, and territories must issue permits for OB/OD facilities that protect the health of communities. In implementing existing requirements, EPA recommends that Regional, state, and territorial permitting authorities, when reviewing applications for initial or renewal permits for OB/OD units, should do the following:

Alternative Technology Evaluations and Waste Characterization

- Require, as part of alternative technology evaluations, information to:
    - Identify and describe the pre-treatment or pre-processing steps that may be needed to enable use of an alternative, and to ensure safe handling or safe treatment of the waste (e.g., resizing or breaking down using a high-pressure waterjet or underwater bandsaw).

[26] Case opening technologies include Reverse Assembly, Fluid Jet Cutting, Cryofracturing, Femtosecond Laser Cutting or Laser Machining, and Submerged Band Saws. For removing energetic material, available technologies include Autoclave Meltout, Induction Heating Meltout, Steam and High-pressure Washout, Dry Ice Blasting, and Ultrasonic Separation or Sonication.

- Describe how alternative technologies capture, control, and monitor emissions and releases to the environment.

- Require detailed waste characterization for each waste stream proposed for OB/OD, that (1) confirms the waste has potential to detonate and is characteristic for reactivity/explosivity (D003); (2) ensures potential contaminants of concern are identified, and (3) enables an evaluation of safe alternative technologies. Such characterization would generally include: a description and amount of each waste; chemical composition, including additives; all applicable hazardous waste codes; net explosive weight (NEW); U.S. Department of Transportation (DOT) hazard class; etc. Such characterization may be based on process knowledge and, where needed, chemical and physical testing results.

- Establish permit conditions/schedules requiring periodic alternative technology evaluations for waste explosives treated by OB/OD, e.g., as new alternatives are developed, if waste streams change, or every five years. Use permit conditions/schedules to require use of safe available alternative technologies, once identified.

Limiting Treatment by OB/OD

- Continue prohibition of treatment of chemical weapons by OB/OD.

- In general, do not allow treatment by OB/OD for the following wastes. If proposed for OB/OD, they should be fully evaluated on a case-by-case basis to determine if adequate justification has been made that there is no other safe mode of treatment:

  - Wastes for which OB/OD can be ineffective and/or disperses explosive residue and contaminants, rather than destroying them, e.g., white phosphorous (WP) and depleted uranium (DU).[27, 28]
  - Combustible wastes that are contaminated or potentially contaminated with explosives (e.g., solvents and other liquids; wood pallets; paper; personal protective equipment; cardboard; plastic items including plastic liners, mops, gloves). Safe alternative technologies (e.g., incineration, burn chambers) are available to treat these types of wastes.
  - Bulky and non-combustible items contaminated or potentially contaminated by explosives (e.g., tanks, containers, pipes, demolition and construction debris, soils, concrete, masonry). These wastes can be safely treated through alternative technologies, including chemical, steam or high-pressure washout, heat, or composting.
  - Small arms ammunition (less than .50 caliber). There are safe alternative technologies (e.g., incineration, burn chambers, popping furnaces) available to treat these types of wastes.

- Work with owners and operators of OB/OD units to minimize waste generation and reduce wastes being open burned/open detonated. Actions may include:

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[27] NASEM noted in their 2019 report that munitions with DU are being demilitarized using alternative treatment and disposal technologies.

[28] EPA is aware of concerns regarding the potential for unsuccessful or incomplete treatment of certain insensitive munitions (IM) by OB/OD. EPA is exploring these concerns and anticipates communicating further on this issue, as needed, in the forthcoming rulemaking.

- Reducing the amount of material being contaminated with explosives, e.g., through segregation or diversion of wastes. This includes conducting accurate waste determinations/tests to confirm wastes are characteristic for reactivity (D003) under 40 CFR 261.23(a)(6-8), and have the potential to detonate per 40 CFR 265.382.
- Storing wastes, when it is safe to do so and pursuant to RCRA regulations or temporary authorizations, until the alternative technology is in operation and while alternative technologies are down for maintenance. This may require building and authorizing additional safe storage capacity.
- When safe to do so, shipping wastes off-site to another treatment facility to be managed by an alternative technology.
- Treating wastes, via non-thermal methods (e.g., soaking, chemical treatment), as allowed by regulation. In general, generators of hazardous waste can conduct non-thermal treatment on-site in enclosed tanks or containers without a RCRA permit.
- Reducing the permitted amount/volume of waste that can be treated in the OB/OD unit until the alternative technology is in operation.

- Require limits, as appropriate, on frequency of OB/OD events and quantity (e.g., by weight and/or NEW) per event by day and/or year. Require limits on duration and timing of OB/OD events (e.g., limit OB/OD to daytime hours only to allow for monitoring of plumes).

- Prohibit acceptance of wastes which are not permitted to be treated or which do not have a proper hazardous waste characterization.

Engineering Controls

- Carefully evaluate permit applications for OB/OD units that are located within 100-year floodplains, to ensure implementation of mitigation measures, such as engineering controls, to adequately prevent washout of waste and hazardous constituents pursuant to 40 CFR 270.14(b)(11)(iv). Permit applications that do not adequately demonstrate that the units are designed and constructed to prevent washout and/or flooding should not be approved.

- Require appropriate engineering controls and measures to prevent/minimize surface, subsurface, and groundwater contamination and aerial dispersion and release and/or migration of residues, kickout and contaminants into the environment and offsite. Controls and measures could include surface water/storm water run-on and run-off controls, concrete pads with integrated curbs and sump pumps, lined drainage ditches, collection basins, blast barriers/shields/blankets, berms, metal cages, metal lids or covers for burn pans, routine operation and maintenance measures including removal of residues, kickout, and visible surface contamination (e.g., black soot, staining, ejecta) from the unit and surrounding area. For example, surface contamination can be removed on a periodic basis as appropriate (e.g., after every event, at the end of each day's operation, weekly).

Monitoring and Recording

- Establish parameters on, and monitoring and recording of, atmospheric and meteorological conditions under which treatment may be performed, including wind direction, wind speed, ceiling level, humidity, and air pollution status, to reduce impacts to surrounding communities.

- Require threshold levels and mitigation measures to minimize noise and ground vibration. Require monitoring of noise and ground vibration per threshold levels. (Note: Noise and ground vibration issues usually pertain only to open detonation but may also apply to open burning of large unit wastes such as rocket motors.) If noise or ground vibration is a problem or potential problem at the facility, the permit should address changes to the design and operating procedures to minimize impacts of noise and ground vibration to offsite persons (such as wind direction, allowable operating times, reducing the amount of NEW for each batch that is treated, sound buffers, etc.). If changes to the design and operating procedures do not reduce the noise or ground vibrations below threshold levels, then relocation of the unit should be required.

- Require monitoring and recording (e.g., in a log) of the direction, duration, and opacity of the smoke plume(s) (e.g., use of "spotters," digital cameras, light detection and ranging, or drones to monitor the plume during the duration of the burn) and the need to take immediate measures, such as halting the treatment whenever the smoke migrates into communities or residential areas. If smoke plumes due to treatment are a problem or potential problem at the facility, the permit should address changes to the design and operating procedures to minimize impacts of smoke plumes to off-site and on-site persons (such as halting treatment when smoke migrates toward communities or residential areas, not burning when the wind direction is toward the community or residential areas, changing allowable operating times and duration of burn, changing the type and amount of fuel that is used to sustain the burn, reducing the total amount of waste in each batch, reducing the amount of NEW for each batch that is treated, etc.). If changes to the design and operating procedures do not prevent the smoke plumes from migrating into communities or residential areas, then relocation of the unit should be required.

- Require, during the operational life of the OB/OD unit, soil, sediment, surface water, groundwater, and air[29] monitoring plans, as appropriate per site-specific conditions and waste streams treated in the OB/OD unit, including products/by products from the treatment itself.

- Require documentation of reburn events, by waste type, as routine reburning can indicate OB/OD is an ineffective treatment for a specific waste.

Community Engagement

- Work with the facility to develop a public participation/community engagement/public notification plan, including community outreach meetings; community participation on advisory boards; advance notification of burn or detonation schedules/events; and publicly accessible information regarding contaminants potentially emitted or released from the OB/OD operations, environmental monitoring data/results, and locations of off-site contamination including kickout areas and areas of groundwater contamination.

[29] Given the dynamic nature of plumes released by OB/OD, EPA notes that monitoring air emissions through stationary monitors has limitations and may result in false assurances that no pollutants are released. EPA's Office of Research and Development is working with DoD on piloting drone technology that would better capture and measure emissions from OB/OD events; however, this technology is still in development.

If anything in this memorandum poses challenges with respect to other program commitments or priorities, or if you have any questions or requests for assistance, please contact Sasha Gerhard (gerhard.sasha@epa.gov; 202-566-0346) or Ken Shuster (shuster.kenneth@epa.gov; 202-566-0353).

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